

"Virulence of Desiccated Tubercular Sputum." By HAROLD SWITHINBANK. Communicated by Sir JAMES CRICHTON BROWNE, F.R.S. Received May 31,—Read June 20, 1901.

In the spring of 1900 two plots of a superficial area of 44 sq. feet each were carefully partitioned off in the experiment house with close mesh-wire netting, and laid down with closely cropped lawn turf, which quickly grew into an even sward.

On the 16th day of May following, the grass of these two plots having been cut as short as possible (not exceeding a length from the ground surface of one-quarter to one-half of an inch), the two plots were watered evenly with 4 gallons of water, in which had been incorporated 3 pints of disintegrated tubercular sputum from the Brompton Consumption Hospital, 2 gallons being distributed over the grass of each plot by means of an ordinary watering can with a rose spout.

The plots were then left for fourteen days under the following conditions, being designated respectively as Plot "T A" and Plot "T B," that is to say :—

Plot "T A" was exposed during the whole of the fourteen days to all climatic influences, including the direct rays of the sun between the hours of 10 A.M. and 6 P.M. The weather was exceptionally dry and fine.

Plot "T B" was for the same period exposed to the same conditions as the above, with the exception of the sun's rays, from which it was carefully shielded.

On the 30th May the following animals were turned down to feed upon the two plots :—

Plot "A."
Two rabbits.
Three guinea-pigs.

Plot "B."
Three rabbits.
Three guinea-pigs.

These animals were marked as follows :—

Rabbit T 2.	Both fore-paws red.	Rabbit T 1.	Right fore-paw red.
Rabbit T 3.	Left fore-paw red.	Rabbit T 4.	Red nose.
Guinea-pig T 6.	Right hind-paw red.	Rabbit T 5.	Blue nose.
Guinea-pig T 7.	Right hind-paw blue.	Guinea-pig T 9.	Right fore-paw red.
Guinea-pig T 8.	Left hind-paw blue.	Guinea-pig T 10.	Both fore-paws red.
		Guinea-pig T 11.	Right fore-paw blue.

The short grass on the plots was quickly eaten down, when the ground became completely bare and, owing to drought and the scratching of the rabbits, covered with a layer of fine dust. The animals were then fed upon moistened bran, contained in dishes, and greenstuff thrown upon the ground.

The two tables marked "A" and "B" respectively, and attached
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hereto, show the general effect of the treatment upon each individual animal. Fuller details of the *post-mortem* results were given on separate sheets.

Plot "A."

Animal.	No.	Distinctive mark.	Killed or died.	Summary of <i>post-mortem</i> results.
Rabbit	T 2	Two fore-paws red	Killed after 6 weeks, 21.7.1900	Tuberculous. Disease chiefly confined to respiratory system. Abundant tubercle in lung structure. Bacilli found in abundance.
Rabbit	T 3	Left fore-paw red	Died after 10 weeks, 13.8.1900	Tuberculous. Infection limited almost entirely to respiratory organs. Lungs crowded with tubercle—("an exaggerated form of miliary tubercle." G.T.B.). Bacilli found in abundance.
Guinea-pig	T 6	Right hind-paw red	Died after 12 days, 11.6.1900	Exact cause of death unknown—apparently over-feeding. Too early to show sign of tubercle.
Guinea-pig	T 7	Right hind-paw blue	Died after 14 weeks, 4.9.1900	Generalised tuberculosis. Specially marked in respiratory system and liver. Lungs crowded with tubercular deposit. Liver enormously enlarged, the anterior portion of lobes consolidated and caseous. Bacilli found in abundance.
Guinea-pig	T 8	Left hind-paw blue	Killed after 15 weeks, 13.9.1900	Generalised tuberculosis. Lungs one mass of tuberculous areas, calcareous and caseating. Pharyngeal glands enlarged and calcareous. Pleura covered with tuberculous patches. Spleen ditto. Caseating nodule on pyloric orifice. Occasional nodules on peritoneum and mesentery, but not so marked. Lymphatic glands of splenic omentum enormously enlarged and caseous.

"Plot B."

Animal.	No.	Distinctive marks.	Killed or died.	Summary of <i>post-mortem</i> results.
Rabbit	T 1	Right fore-paw red	Died after 25 days. 23.6.1900	Generalised tuberculosis. Specially marked in respiratory system. Lungs crowded with tuberculous areas, distributed equally through the organ.
Rabbit	T 4	Red nose ...	Killed. 4.10.1900	Tuberculous. Abundant tubercle in lung structure. Glands of fauces much enlarged and tuberculous. Bacilli found in abundance.
Rabbit	T 5	Blue nose ..	Killed. 4.10.1900	Tuberculous. Lungs crowded with miliary tubercles. Kidneys much enlarged, and covered with tuberculous nodules. Bacilli found in abundance.
Guinea-pig	T 9	Right fore-paw red..	Killed. 4.10.1900	Tuberculous. Disease not marked, and confined wholly to rare tubercles in lung structure. Bacilli found, but in small numbers.
Guinea-pig	T 10	Both fore-paws red	Killed. 4.10.1900	Non-tuberculous. Organs all healthy.
Guinea-pig	T 11	Righ fore-paw blue	Killed. 4.10.1900	Non-tuberculous. All organs healthy with exception of lungs. These much congested and patchy, but no perceptible tubercle. No bacilli found.

From the above it will be seen that, eliminating one guinea-pig which died at an early stage of the experiment from other causes, 80 per cent. of the experimental animals were found at death to be suffering from tuberculosis in a very marked degree, and although in most cases this was generalised, yet in all it was the respiratory system in which the disease was most marked. The state of many of these was described by Sir George Brown (to whom I am very greatly indebted for the kind and unfailing aid he has given me in checking and supervising the results of every *post-mortem*) as extraordinary, and the specimens preserved will show to what an extent these organs were affected.

Two animals alone remained unaffected, and these were found quite free from tubercle when killed at the end of five months from the date

of the commencement of the experiment. I can only attribute this immunity to a very high degree of natural resistance which at times is met with in all experimental animals, and which we are compelled to allow for.

Eighteen animals were born during the course of the experiment, at intervals of 4, 5, 9, and 13 weeks, all of whose parents subsequently were found to be tuberculous. These were killed and examined at intervals, and in not one of them was there evidence of tuberculosis. It would therefore be not unreasonable to suppose that, although desiccation for a period of fourteen days proved insufficient to destroy, under these conditions, the virulence of the sputum, yet this was accomplished at some point between this and four weeks. What this point is, a further experiment on similar lines when sufficient sunlight is available, will be necessary to elucidate. I propose to carry this out in the early summer of next year.

“Effect of Exposure to Liquid Air upon the Vitality and Virulence of the *Bacillus Tuberculosis*.” By H. SWITHINBANK.
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A series of experiments carried out early in the year 1900 with the object of testing the effect of the temperature of liquid air upon the vitality and virulence of the *bacillus tuberculosis* produced results which, although in complete accord as far as the question of vitality was concerned with those arrived at by Professor Macfadyen in the carefully planned experiments reported to the Royal Society on the 1st February and the 5th April, 1900, raised some doubt in my mind as to whether the abnormally low temperature, continued for a lengthened period, might not have some modifying effect upon the virulence of the organism. I decided therefore, in the month of January of this year, to put the question to the test of an experiment which I hoped would be conclusive.

The questions to be solved appeared to me to be—

1. Whether exposure for varying periods to the temperature of liquid air had any effect upon the vitality of the *bacillus tuberculosis*.
2. Whether such exposure in any way modified its virulence.
3. Whether time was a factor in the question.
4. Whether, as is the case at the higher end of the thermometric scale, successive alternations of temperature had any special effect.
5. Whether actual contact* with liquid air, if obtainable, produced any special results.

* The word “contact” is used throughout, but it is doubtful whether actual